

We claim:

1. A flower-shaped vertical alignment (FVA) structure liquid crystal display (LDC) with  
5 fast response, high contrast ratio and wide view angle comprising:
  - (a) a first substrate with a protrusion shaped electrode as the pixel electrode;
  - (b) a second substrate as the common electrode;
  - (c) aligning layers formed on said first and second substrates providing liquid  
crystal vertical alignment;
  - 10 (d) liquid crystal materials filling a space between said first and second substrates  
as a liquid crystal cell;
  - (e) a linear polarizer and wide band quarter-wave film forming a circular  
polarizer; and,
  - (f) the circular polarizer disposed on exterior surfaces of the liquid crystal cell.
- 15 2. The FVA structure liquid crystal display of claim 1 wherein the second substrate  
has an empty hole.
3. The FVA structure liquid crystal display of claim 1 wherein the second substrate  
20 has a hexagon-shaped hole.
4. The FVA structure liquid crystal display of claim 1 wherein the aligning layer is a  
polymer.

5. The FVA structure liquid crystal display of claim 1 wherein the aligning layer is an inorganic material.

6. The FVA structure liquid crystal display of claim 1 wherein the protrusion  
5 electrode has a shape selected from at least one of: conic, spherical, semi-spherical tower, pyramid and column-like.

7. The FVA structure liquid crystal display of claim 2 wherein the protrusion electrode includes an indium tin oxide (ITO) layer.

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8. The FVA structure liquid crystal display of claim 2 wherein the shape of the empty hole is selected from at least one of: circular, elliptical ring-shaped, square and rectangular.

15 9. The FVA structure liquid crystal display of claim 1 wherein the common electrode includes an ITO layer.

10. The FVA structure liquid crystal display of claim 9 wherein the common electrode includes wall-bump protrusions on the ITO layer.

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11. The FVA structure liquid crystal display of claim 1 wherein the liquid crystal materials have a positive ( $\Delta\epsilon > 0$ ) dielectric anisotropy.

12. The FVA structure liquid crystal display of claim 1 wherein the liquid crystal materials have a negative ( $\Delta\epsilon < 0$ ) dielectric anisotropy.
13. The method of making a wide view angle, fast response, high contrast ratio liquid crystal display (LCD) with a flower-shaped vertical alignment (FVA) comprising the steps of:
- 5 (a) providing a first substrate with a protrusion shaped electrode as a pixel electrode;
- (b) providing a second substrate as a common electrode in a parallel arrangement with the first substrate;
- 10 (c) filling a space between the first and second substrates with a liquid crystal material;
- (d) vertically aligning the liquid crystal material;
- (e) forming a circular polarizer in the liquid crystal display (LCD); and
- (f) applying a voltage to the LCD to generate an electric field distribution having a
- 15 flower blossom configuration in order to provide the LCD with the wide view angle, fast response, and high contrast ratio..
14. The method of claim 13 wherein the second substrate has an empty hole.
- 20 15. The method of claim 13 wherein the second substrate has a hexagon-shaped hole.
16. The method of claim 13 wherein the aligning layer is a polymer.
17. The method of claim 13 wherein the aligning layer is an inorganic material.

18. The method of claim 13 wherein the protrusion electrode in the first substrate has a shape selected from at least one of: conic, spherical, semi-spherical tower, pyramid and column-like.
- 5 19. The method of claim 13 wherein the protrusion electrode includes an indium tin oxide (ITO) layer.
20. The method of claim 14 wherein the shape of the empty hole is selected from at least one of: circular, elliptical ring-shaped, square and rectangular.
- 10 21. The method of claim 13 wherein the common electrode includes an indium tin oxide (ITO) layer.
22. The method of claim 21 wherein the common electrode includes wall-bump  
15 protrusions on the ITO layer.
23. The method of claim 13 wherein the liquid crystal materials have a positive ( $\Delta\epsilon > 0$ ) dielectric anisotropy.
- 20 24. The method of claim 13 wherein the liquid crystal materials have a negative ( $\Delta\epsilon < 0$ ) dielectric anisotropy.
25. The method of making a wide view angle, fast response, high contrast ratio liquid crystal display (LCD) with a flower-shaped vertical alignment (FVA) comprising the steps of:

- (a) vertically aligning substrates about a liquid crystal;
  - (b) polarizing an output from the LCD with a circular polarizer;
  - (c) applying a voltage to the LCD to generate an electric field having generally expanding concentric patterns in order to provide the LCD with the wide view angle,
- 5 fast response, and high contrast ratio.
26. The method of claim 25 wherein the generally expanding concentric patterns are shaped like a flower blossom.